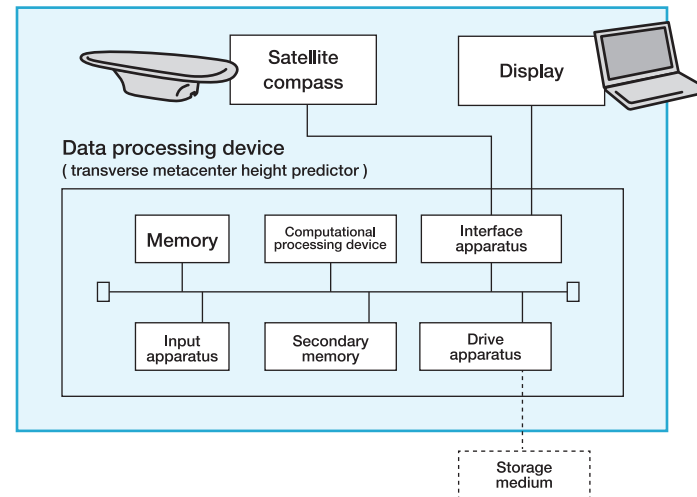## Specifications

■ Name	Oceanus Ocean Waves Prediction System
■ Input data	Hull form: displacement, trim, GM Ship motion: pitching, rolling, heaving
■ Output data	Ocean waves: wave height, period (wave length), direction (primary, secondary), GoM
■ Components	Response of amplitude: satellite compass SC-70(Furuno Electric Co., Ltd.) Data processing/analysis: Windows PC

■ System schematic

Maritime meteorology prediction system

Computer dispay output

Fluid Techno Co., Ltd.

6F, 1-7 Tokiwa-cho, Sasebo-shi,
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Real Time Detection System for Encountering Ocean Waves

Oceanus

◇ For safety and economical operation

◇ Fuel oil consumption and environmental loading reduction

◇ Assessment of operating track

◇ For green ship

i FTC FLUID TECHNO Co., Ltd.

Real time detection of encountering ocean waves by recording ship motion

Oceanus

During service of ship, big data is acquired and applied to select economical routes with safety and to assess environmental contribution. Encountering sea state data, however, cannot be obtained during a voyage. Oceanus is a device that is installed on the vessel and allows for real-time predictions of sea state such as wave in order to support safe, economical, and fuel-efficient ("green ship") navigation.

Windows PC & satellite compass SC-70

Advantages of Oceanus

1 Supporting safe navigation

Detection of sea state at service

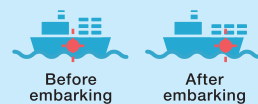| Standard voyages	Oceanus
Data of sea state in the route is normally provided by a weather routing estimation organization. Encountering sea state is checked with naked eyes.	Encountering ocean waves is detected in real time through measuring ship motion. Wave height, length and main direction are recorded in real time.

Height of center of quality (GoM) record at all the time

Standard voyages	Oceanus
GoM is calculated by loading computer before leaving a port, which is moved in service.	GoM is estimated in real time through measuring ship motion, rolling.

Before embarking   After embarking

2 Saving fuel consumption

Real time detection of encountering ocean waves through ship motion assists to select optimal for saving fuel consumption and green operation.

ECOLOGY

Precision analysis and predictions of ocean waves and ship loading condition

Features of Oceanus

Ocean waves prediction system applicable to ships such as VLCC to fishing boat.

Ocean waves prediction system is developed for practical application through collaborative research with the National Research and Education Agency(FRA) and Furuno Electric Co., Ltd.
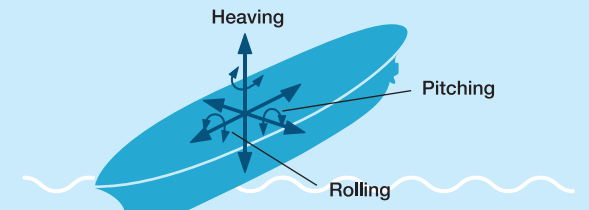
Ship motion measurements in real time

Encountering ocean waves prediction method wave height, length, direction and GoM estimation are researched and their monitoring system is developed. A program for computer is also prepared. Encountering waves and GoM are recorded every five minutes and displayed on the screen.

Prediction of encountering waves with high precision

Precise ship motion detection and accurate analysis for prediction

Three motions including rolling, pitching and heaving are measured with satellite compass or gyroscope in real time.

Heaving
Pitching
Rolling

Ship motion measurement analysis in real time

## Examples of ocean wave's prediction

Fishing vessel (19 tonnage purse seine ship)

- Processing method : real-time processing
- Measuring time: Feb.-Mar. 2013
- Analyzed data : 300 data in total, which were acquired at every second during five minutes

Results Predicted results from on-vessel calculations matched well with actual Meteology Agency buoy readings

Comparison with Ikitsukishima Island Meteorology Agency wave data measured by buoy 1/29/2013

Time(h)
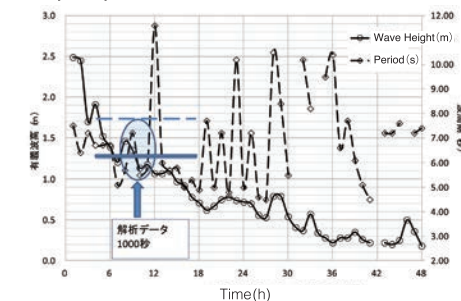
Model test in basin

| No.	Wave sought by motion measurement			Wave by wave maker		
	Wave height [m]	Period [sec]	Encounter angle [°]	Wave height [m]	Period [sec]	Angle of encounter [°]
1	0.90	4.37	0	1.0	4.52	0
2	0.87	3.81	0		3.90	
3	0.27	4.06	-30		2.87	
4	0.82	6.28	0	1.0	6.02	10
5	1.51	3.73	0		3.15	
6	0.63	5.92	10	0.8	6.02	30
7	0.95	3.69	20		2.76	

Domestic container ship voyage data

- Vessel : Lpp 85.0m B 14.0m D 8.85m d 3.61m
- Processing method : real-time processing
- Measuring time: Feb.-May 2015
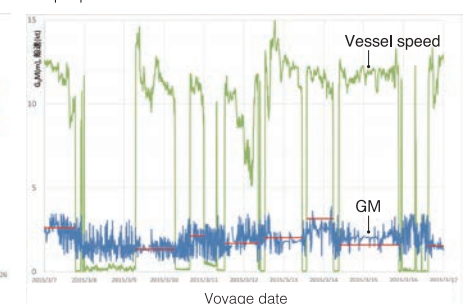- Analyzed data: 300 data in total, which were acquired at every second during five minutes

Results Height of center of gravity predicted by rolling motion was slightly lower than that from stowage calculations by loading computer

Comparison between measured GM and Loading Computer

Voyage date

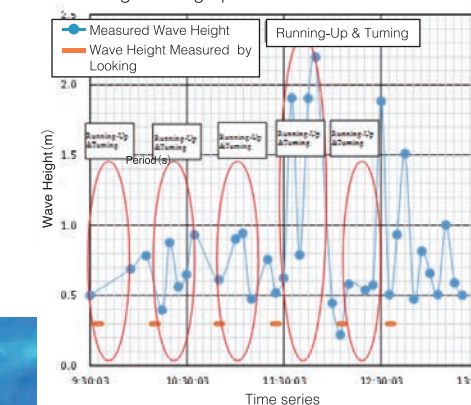Ship speed and GoM

Vessel speed

GM

Voyage date
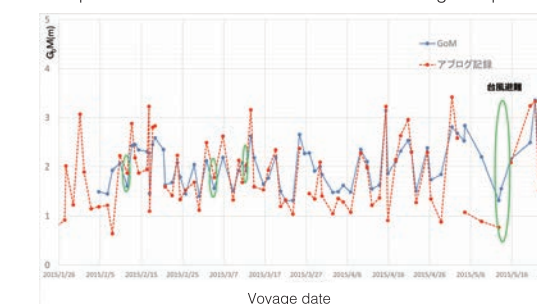
25K DWT tanker

- Processing method: real-time processing
- Measuring time: Nov. 2014
- Analyzed data: 300 data in total, which were acquired at every second during five minutes

Results Predicted results were reasonable for usage for trial runs

Wave Height during Speed Trial

Measured Wave Height
Wave Height Measured by Looking
Running-Up & Turning

Time series

Wave Period during Speed Trial

Measured Wave Period

Time series